UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,710	02/07/2006	Shigeru Nishio	64846 (70904)	3885

21874 7590 08/04/2009
EDWARDS ANGELL PALMER & DODGE LLP
P.O. BOX 55874
BOSTON, MA 02205

EXAMINER	
WITKOWSKI, ALEXANDER C	

ART UNIT	PAPER NUMBER
2853	

MAIL DATE	DELIVERY MODE
08/04/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/567,710	Applicant(s) NISHIO ET AL.	
	Examiner ALEXANDER C. WITKOWSKI	Art Unit 2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 28 May 2009.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-23 is/are pending in the application.

4a) Of the above claim(s) 16-23 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-15 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 03/26/2009.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicants' submission filed on 05/28/2009 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 - 10, 12, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato (JP 56098172) in view of Peeters et al. (US 6,340,216) and Lin et al. (US 6,328,393).

Regarding claim 1, as currently amended, Sato teaches an electrostatic suction type fluid discharge device (Abstract), and ejected drops of ink are supplied between nozzle 1a and paper [in which drive voltage supply means supplies a drive voltage

between a nozzle and a discharge target] 6 with a formation of parallel plate capacitor 4a,b from the nozzle [hence an electric charge is applied to a fluid supplied into the nozzle] 1a, and drops of ink are discharged [so that the fluid is discharged **as** droplets] from nozzle 1a to the paper [from a hole of the nozzle to the discharge target] 6; see also Sato: JP 56098172: translation).

However, Sato does not teach a drive voltage with bipolar pulse voltage which has a frequency of not less than 1 Hz. Peeters teaches a drive voltage with bipolar pulse voltage which has a frequency of not less than 1 Hz (Peeters et al.: col.20, Table 2: disclosing AC drive frequency at 2 kHz).

Sato teaches the drive voltage supply means outputting as the drive voltage, a bipolar pulse voltage which alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target** (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of

the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

It would have been obvious to one of ordinary skill in the art at the time of this invention to modify the invention of Sato with the invention of Peeters et al. so as to reduce the accumulation of charge from impinging charged droplets on the substrate target.

However, the combination of Sato and Peeters et al. references does not teach the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter. Peeters et al. also does not teach positively charged fluid **droplets** and negatively charged fluid **droplets** are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target**.

Lin et al. teaches the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm).

It would have been obvious to one of ordinary skill in the art at the time that this invention was made to modify the inventions of Sato and Peeters et al. with the invention of Lin et al. to provide the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter, as taught by Lin et al., so as to produce ink droplets of relatively small diameter in order to achieve higher resolution print output.

Regarding claim 2, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge device (Sato: Abstract; Fig.2; see also Sato: JP 56098172: translation),

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the drive voltage supply means outputting, as the drive voltage, a bipolar pulse voltage which alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternatively landed on the discharge target,** (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation)

and **which** satisfies $f \leq 1/(2\tau)$ where τ is a time constant determined by $\tau = \varepsilon / \sigma$, f is a drive voltage frequency (Hz), σ is an electric conductivity (S/m) of the discharge fluid, and ε is a relative permittivity of the discharge fluid (Peeters et al.: col.20, lines 36-

47: disclosing AC [bipolar pulse] voltage driving material [fluid] 282 to electrode 54, and having a frequency twice droplet transit time [$f \leq 1/2\tau$])

Regarding claim 3, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge device (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage])

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm; see also Sato: JP 56098172: translation),

the drive voltage supply means outputting, as the drive voltage, a bipolar pulse voltage which has a frequency of fHz and which alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target**, (Peeters et al.: col.20, lines 36-47: disclosing AC [bipolar pulse] voltage driving material

[fluid] 282 to electrode 54, and having frequency twice droplet transit time [$f \leq 1/2\tau$]) (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]), and

the electrostatic suction type fluid discharge device further **comprises** control means that controls at least one of the drive voltage supply means and the shifting means (Peeters et al.: Fig.1: showing control of propellant [fluid] 14 ejector 12 by drive voltage) in such a manner as to satisfy $f \geq 5v$ where f is a drive voltage frequency (Hz) of the drive voltage supply means and v indicates a relative speed (μm / sec) of the relative movement of the nozzle and the discharge target (choice of design to avoid gaps in printing).

Regarding claim 4, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge device (Sato: Abstract) in which drive voltage supply means supplies a drive voltage between a nozzle and a discharge target and hence an electric charge is applied to a fluid supplied

into the nozzle so that the fluid is discharged **as droplets** from a hole of the nozzle to the discharge target and the nozzle and the discharge target are moved in a relative manner by shifting means, in a direction orthogonal to a direction along which the nozzle and the discharge target oppose to each other (Sato: Abstract: disclosing discharge of selectively [drive voltage supply means] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [electrostatic suction type fluid discharge device] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation),

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the drive voltage supply means outputting, as the drive voltage, a bipolar pulse voltage which is not more than 400V and which alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target** (Peeters et al.: col.20: Table 2: disclosing drive voltages in the range of 0 to 500 volts) (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and

negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

Regarding claim 5, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge method (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54), in which a drive voltage is supplied between a nozzle and a discharge target (col.17, lines 61-62: disclosing formation of parallel plate capacitor by meniscus and electrode 54) and hence an electric charge is applied to a fluid supplied into the nozzle (col.17, lines 62-64: disclosing that electrode 54 imparts proper charge to droplet from the meniscus), so that the fluid is discharged **as droplets** from a hole of the nozzle to the discharge target (Fig.3: 42, 54),

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the drive voltage being a bipolar pulse voltage which has a frequency of not less than 1 Hz and alternates between positive and negative such that positively charged

fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target** (Peeters et al.: col.20, lines 36-47: disclosing AC [bipolar pulse] voltage driving material [fluid] 282 to electrode 54, and having a frequency twice droplet transit time; see also col.20, Table 2: disclosing AC drive frequency at 2 kHz) (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

Regarding claim 6, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge method (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54), in which a drive voltage is supplied between a nozzle and a discharge target (col.17, lines 61-62: disclosing formation of parallel plate capacitor by meniscus and electrode 54) and hence an electric charge is applied to a fluid supplied into the nozzle (col.17, lines 62-64: disclosing that electrode 54 imparts proper charge to droplet from the

meniscus), so that the fluid is discharged **as droplets** from a hole of the nozzle to the discharge target (Fig.3: 42, 54),

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the drive voltage being a bipolar pulse voltage which alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target,** and **which** satisfies $f \leq 1/(2\tau)$ where τ is a time constant determined by $\tau = \varepsilon / \sigma$, f is a drive voltage frequency (Hz), σ is an electric conductivity (S/m) of the discharge fluid, and ε is a relative permittivity of the discharge fluid (Peeters et al.: col.20, lines 36-47: disclosing AC [bipolar pulse] voltage driving material [fluid] 282 to electrode 54, and having frequency twice droplet transit time [$2f \leq 1/\tau$]) (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]).

Regarding claim 7, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge method (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54), in which a drive voltage is supplied between a nozzle and a discharge target (col.17, lines 61-62: disclosing formation of parallel plate capacitor by meniscus and electrode 54) and hence an electric charge is applied to a fluid supplied into the nozzle (col.17, lines 62-64: disclosing that electrode 54 imparts proper charge to droplet from the meniscus), so that the fluid is discharged **as droplets** from a hole of the nozzle to the discharge target (Fig.3: 42, 54), and the nozzle and the discharge target are moved in a relative manner, in a direction orthogonal to a direction along which the nozzle and the discharge target oppose to each other (Fig.3: showing discharged fluid directed orthogonally to a direction along which the nozzle 42 and discharge target 54 oppose each other; see also col.17, lines 63-64: disclosing that propellant redirects discharged fluid droplet from meniscus, which droplet is pulled into channel 46),

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), as the drive voltage, a bipolar pulse voltage which has a frequency of f Hz being outputted and alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target**, and at least one of the drive voltage frequency fHz and a relative speed vμm / sec of the relative movement of the nozzle

and the discharge target being controlled in such a manner as to satisfy $f \geq 5v$ (choice of design to avoid gaps in printing) (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

Regarding claim 8, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge method (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54), in which a drive voltage is supplied between a nozzle and a discharge target (Fig.3: showing meniscus at ports 42 charged by electrode 54) and hence an electric charge is applied to a fluid supplied into the nozzle (col.17, lines 62-64: disclosing that electrode 54 imparts proper charge to droplet from the meniscus), so that the fluid is discharged **as droplets** from a hole of the nozzle to the discharge target (Fig.3: 42, 54),

the hole of the nozzle falling within a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the drive voltage being a bipolar pulse voltage which is not more than 400V and which alternates between positive and negative such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage **and alternately landed on the discharge target** (Peeters et al.: col.20: Table 2: disclosing drive voltages in the range of 0 to 500 volts) (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

Regarding claim 9, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge device (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54) that (i) discharges, by electrostatic suction, a discharge fluid through a fluid discharge hole of a nozzle of a fluid discharge head (col.17, lines 61-62: disclosing formation of parallel plate capacitor by meniscus and electrode 54), the discharge fluid being electrically charged by voltage application (col.17, lines 62-64: disclosing that electrode 54 imparts

proper charge to droplet from the meniscus), and (ii) causes the discharge fluid to land onto a substrate (col.24, lines 31-35), (iii) so as to form a drawing pattern by the discharge fluid on a surface of the substrate (col.9, lines 63-66: disclosing preformed electrodes 314 in rectangular, annular, or other shape in plan form),

the fluid discharge hole of the nozzle falling in a range between φ0.01μm and φ25μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the substrate being insulating (Peeters et al.: Fig 40E; col.9, line 63 to col.10, line 9: disclosing dielectric layer 316 to protect electrode 314),

the electrostatic suction type fluid discharge device comprising:

charge removal means for removing an electric charge on the surface of the substrate, before the discharge fluid is discharged onto the substrate (Peeters et al.: col.20, lines 36-47: disclosing AC [bipolar pulse] voltage driving material [fluid] 282 to electrode 54; note that substrate charge is zero when bipolar drive voltage is zero before each fluid discharge); and

fluid discharge means for discharging, the discharge fluid onto the substrate from which the electricity has been removed by a which alternates between positive and negative such that a positively charged fluid and a negatively charged fluid are alternately discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity

of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

Regarding claim 10, the combination of Sato, Peeters et al., and Lin et al. references teaches the electrostatic suction type fluid discharge device as defined in claim 9, wherein, the charge removal means removes the electricity on the substrate, in line with a predetermined pattern (Peeters et al.: col.20, lines 36-47: disclosing AC [bipolar pulse] voltage driving material [fluid] 282 to electrode 54; note that substrate charge is zero when bipolar drive voltage is zero before each fluid discharge).

Regarding claim 12, the combination of Sato, Peeters et al., and Lin et al. references teaches the electrostatic suction type fluid discharge device as defined in claim 11, wherein, the voltage applied when the fluid discharge means discharges the discharge fluid is not less than 340V (Peeters et al.: col.20: Table 2: disclosing drive voltages to 500 volts).

Regarding claim 15, as currently amended, the combination of Sato, Peeters et al., and Lin et al. references teaches an electrostatic suction type fluid discharge

method (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54) in which (i) by electrostatic suction, a discharge fluid is discharged **as droplets** through a fluid discharge hole of a nozzle of a fluid discharge head, the discharge fluid being electrically charged by voltage application (col.17, lines 62-64: disclosing that electrode 54 imparts proper charge to droplet from the meniscus), and (ii) the discharge fluid **droplets are** caused to land onto a substrate (col.24, lines 31-35), (iii) so that a drawing pattern is formed by the discharge fluid **droplets** on a surface of the substrate (col.9, lines 63-66: disclosing preformed electrodes 314 in rectangular, annular, or other shape in plan form),

the fluid discharge hole of the nozzle falling in a range between φ0.01 μm and φ25 μm in diameter (Lin et al.: col.2, lines 29-32: disclosing nozzle diameters of 10 to 25 μm), and

the substrate being insulating (Peeters et al.: Fig 40E; col.9, line 63 to col.10, line 9: disclosing dielectric layer 316 to protect electrode 314),

an electric charge on the surface of the substrate being removed, before the discharge fluid is discharged onto the substrate (Peeters et al.: col.20, lines 36-47: disclosing AC [bipolar pulse] voltage driving material [fluid] 282 to electrode 54; note that substrate charge is zero when bipolar drive voltage is zero before each fluid discharge), and

the discharge fluid being discharged onto the substrate from which electricity has been removed by a bipolar pulse voltage such that positively charged fluid **droplets** and negatively charged fluid **droplets** are alternatively discharged in accordance with a

polarity of the bipolar pulse voltage applied as the drive voltage **and caused to alternately land on the substrate** (Sato: Abstract: disclosing discharge of selectively [alternately] charged positive and negative drops of ink [positively charged fluid droplets and negatively charged fluid droplets] alternately discharged and coordinated with a polarity of bipolar pulse as the drive voltage; see also Fig.2: showing print signal generator [drive voltage supply means] outputting an alternating charge deflection type printing electric drive signal [bipolar pulse voltage], with positively and negatively charged ink drops [such that a positively charged fluid and a negatively charged fluid are alternatively discharged in accordance with a polarity of the bipolar pulse voltage applied as the drive voltage]; see also Sato: JP 56098172: translation).

4. Claims 11, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumotu (JP 56098172) in view of Peeters et al. (US 6,340,216) and Lin et al. (US 6,328,393), as applied to claim 9 above, and further in view of Ohno et al. (US 6,096,468).

Regarding claim 11, the combination of Sato, Peeters et al., and Lin et al. references teaches the electrostatic suction type fluid discharge device as defined in claim 9, wherein, the fluid discharge means discharges the discharge fluid by applying a voltage which is arranged such that an electric field strength generated by electric charge concentration at a meniscus part (Peeters et al.: Fig.3: showing meniscus at ports 42 charged by electrode 54).

However, the combination of Sato and Peeters et al., and Lin et al. references does not teach that the electric field strength, when discharging the discharge fluid, is smaller than a discharge start electric field strength figured out by an equation for calculating Paschen curve.

Ohno et al. teaches that the electric field strength, when discharging the discharge fluid, is smaller than a discharge start electric field strength figured out by an equation for calculating Paschen curve (Ohno et al.: col.40, lines 43-50: disclosing need for field strength to be smaller than that calculated by Paschen curve).

It would have been obvious to one of ordinary skill in the art at the time that this invention was made to modify the combination of Sato and Peeters et al., and Lin et al. references such that the electric field strength, when discharging the discharge fluid, is smaller than a discharge start electric field strength figured out by an equation for calculating Paschen curve, as taught by Ohno et al., for the purpose of avoiding attraction and adhesion of the toner to the charging member, which would deteriorate the toner (Ohno et al.: col.40, lines 43-50).

Regarding claim 13, the combination of Sato, Peeters et al., and Lin et al. and Ohno et al. references teaches the electrostatic suction type fluid discharge device as defined in claim 11, wherein, the fluid discharge hole of the nozzle is not less than 16 μm or not more than 0.25 μm in diameter (Lin et al.: col.2, lines 27-32: disclosing nozzle diameters of 10 to 80 μm), and the voltage applied when the fluid discharge means

discharges the discharge fluid is not more than 500V (Peeters et al.: col.20: Table 2: disclosing drive voltages in the range of 0 to 500 volts).

Regarding claim 14, the combination of Sato, Peeters et al., and Lin et al. and Ohno et al. references teaches the electrostatic suction type fluid discharge device as defined in claim 11, wherein, the fluid discharge hole of the nozzle is not less than 7.4 μm or not more than 0.65 μm in diameter (Lin et al.: col.2, lines 27-32: disclosing nozzle diameters of 10 to 80 μm), and the voltage applied when the fluid discharge means discharges the discharge fluid is not more than 400V (Peeters et al.: col.20: Table 2: disclosing drive voltages in the range of 0 to 500 volts).

Response to Arguments

5. Applicant's arguments with respect to claim 1 - 23 have been considered but are moot in view of the new grounds of rejection.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEXANDER C. WITKOWSKI whose telephone number is (571) 270-3795. The examiner can normally be reached on Monday to Friday 8:00 AM to 6:30 PM EST, except alternate Thursdays and Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen D. Meier can be reached on 571-272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. C. W./
Examiner, Art Unit 2853

/Stephen D Meier/
Supervisory Patent Examiner, Art Unit 2853